Transmission & Reliability Issues

Electricity is both vital and unique, since it must be produced and consumed simultaneously. That makes the ability to deliver power when and where it is needed one of the most important aspects of electricity markets. It is often the lack of adequate transmission capability, rather than a lack of generating capacity, that is the cause of costly price fluctuations or supply interruptions.

Uncertainty and rapid change in the utility industry will keep transmission and reliability issues in the forefront for the foreseeable future.

The Evolution of U.S. Transmission Systems

Transmission systems were built over time by utilities to serve the specific power needs of the areas in which they provide power. Before the Energy Policy Act of 1992, each utility could take its own unique approach to wheeling others' power across its lines. As the Federal Energy Regulatory Commission (FERC) changed and standardized the rules governing transmission, it became desirable to move power longer distances.

The exchange of power among regions began to increase, creating new markets and new problems. The most significant of these was that use of the transmission system began to grow much faster than transmission capacity growth. There have been many reasons for this disparity, including siting problems, lack of investment incentive, lack of transmission congestion pricing in most markets, and local governmental issues.

FERC has taken steps to try to solve these problems and foster the development of competitive wholesale markets. In 1996, FERC issued the first of three of a series of orders in this regard:

Order 888 – required all utilities that were subject to FERC jurisdiction to file open access and nondiscriminatory transmission tariffs under which all eligible customers can take transmission service.

Order 889 – issued as a companion to Order 888, Order 889 required such utilities to separate the functions of providing transmission service from wholesale power sales and to implement codes of conduct to limit communications between the wholesale power merchant functions and transmission functions. Transmission operators were also required to post their available transmission capacities and accept transmission reservations, even their own, on an electronic bulletin-board system.

Order 2000 – issued in 1999, this order was intended to encourage the development of regional transmission organizations (RTOs) by encouraging utilities to put their transmission systems under the direction of qualifying RTOs that would independently operate them.

The State of U.S. Transmission Systems

Reliability depends upon delivering electricity in the right amounts precisely when and where it is needed. In order to improve system reliability, utilities must maintain adequate generating capacity, transmission capacity, and system reserve margins. However, there are a number of other factors that contribute to electricity system reliability problems that are often not under the utility's control.

Factors that result in distribution and transmission-system failures include weather events such as ice storms, accidents, short circuits caused by wildlife, and unanticipated failures of equipment. While great advances have been made in power-industry technology, there still are only limited ways to economically store electricity in any significant amount.

The growth of transmission capacity throughout the nation has lagged behind the development of new power-generating sources. The North American Electric Reliability Council (NERC), in its October 2002 *Reliability Assessment 2002-2011,* states that "transmission systems are reaching their limits as [they are] subjected to new loading patterns resulting from increased electricity transfers and customer demand increases." Very shortly, there may be areas of the national transmission infrastructure that will be unable to meet the demand placed on them. Going forward, reliability will be dependent on several critical factors:

- **Close Coordination of Generation and Transmission**

  In NERC's October 2002 Reliability Assessment 2002-2011, it is estimated that resource adequacy should be satisfactory and that transmission systems should perform reliably through 2006. The number of power-generation projects being cancelled or postponed is now exceeding the number of new projects being announced – a trend that began in late 2001. However, the amount of planned generation is still significant, and demand for power is expected to continue to increase by about 2 percent per year through 2011.

  The problems with reliability are not purely a question of resource reliability – over the last decade, reliability problems have come from the separation of transmission and generation planning. Site-location decisions for new generation have been made without adequate consideration of all of the transmission costs associated with reaching the marketplace. If transmission prices do not properly place these costs on those siting new generation, other transmission-system users – and ultimately native load customers – will unfairly bear these costs. Un-economical siting decisions are being made with new generation being constructed where fuel and other input costs are low, rather than being constructed adjacent to the loads they plan to serve. Transmitting the power from this generation ultimately may clog power lines that were designed for local traffic, thereby imposing undue burdens and costs on the other transmission users. Transmission-congestion pricing and equitable rules about who will pay for different types of transmission investment are necessary to help resolve these problems and help achieve well-functioning wholesale markets for electricity.

Transmission & Reliability Issues

NERC expects 6,551 miles of new transmission lines of 230 kV or higher capacity, an increase of only four percent, to be added across the country over the next four years. Most of these additions will address local transmission concerns or connect new generators to the transmission grid, not transfer power over long distances. By comparison, new generation additions of about 148,000 MW are expected to be constructed – an increase of 18 percent – over the same period. However, NERC points out, "New constraints are appearing as electricity-flow patterns change. In many cases where re-dispatch options have been exhausted or are ineffective, the only way to remove the constraints is to increase the capability of the transmission system or build new generation close to the demand centers, removing the need for electricity transfers in the first place." Increases in generation capacity will help increase reliability only if transmission investment and transmission planning are adequate to deliver energy to demand centers.

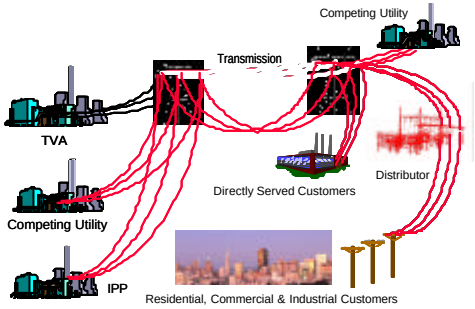
- **Consideration of Power "Loop Flow" Issues**

Electricity flows according to the laws of physics rather than according to the "contract paths" that have typically been used to determine which transmission systems receive compensation for particular transmission transactions. Transmission is typically reserved along the path of "least cost resistance" while power flows along the path of least electrical resistance, causing power from one system to flow across the lines of other systems. While these other systems are not involved in the financial transaction, power nonetheless flows across their lines. The neighboring transmission providers receive no compensation for carrying these "loop flows," but must deal with the congestion "loop flows" cause.

Today's transmission system was designed to carry local generation to local customers, with very little excess capacity for off-system or "through" transactions. One of the main reasons there has been a lack of investment in transmission is that there has been little economic incentive to do so. Under current regulatory requirements, utilities are being required to physically connect new generators built by independent power producers or marketers to their transmission systems. Resolving the issue of loop flows and proper compensation for transaction transmission will be critical to ensuring reliability in the future.

The New Electricity Market

This diagram illustrates the increased demand that is being placed on traditional transmission systems from an array of new sources. The transmission system cannot continue to provide the reliability the nation is accustomed to unless upgrades are made. A fair resolution to the question of who should bear the costs of those upgrades is critical.



- **Diversification of Generating Resources**

  Under state regulation, vertically integrated utilities have typically based generation-capacity investments on certain benchmarks, such as meeting adequate reserve margins. Decisions about capacity and fuel sources were reviewed by state regulatory commissions. In the emerging marketplace, an increasing amount of the nation's power is being produced by merchant generation sources that burn natural gas, often without any regulatory control over generating capacity or fuel choice.

  The recent glut of excess capacity fueled by natural gas has greatly increased the risk of interruptions posed by natural-gas delivery systems to the nation's electricity supply. Stability across the grid is increasingly dependent on the balance between natural gas delivery and power output. Loss of pressure on a single natural-gas pipeline, for example, could result in the loss of output from several generators, causing power-system instability.

  Many of these plants have the capability of burning alternatefuels, but it is unlikely that this capability would completely offset the loss of fuel supply. As NERC points out in its *Reliability Assessment 2002-2011*, some generators "would need to be taken offline to switch out burners in a situation like this, the supply of alternate fuel might not be available because these supplies are typically burned as a hedge against gas price spikes, on-site storage of alternate fuels might not be enough to offset extended interruptions of gas supplies and others might not be able to switch due to environmental limitations." Furthermore, as natural-gas supplies dwindle and gas prices increase, electricity supply may dramatically decrease if merchant generators, with no obligation to serve, find it more economical to cease generating.

TVA's Posture in an Evolving Industry

The electric-utility industry is in a state of flux. TVA is closely monitoring changes in legislation, regulation, and industry practices that could affect the reliability of the grid or cost of service in the TVA region. While much remains to be determined about the future of the North American grid, there are already challenges and impacts to be faced by grid operators resulting from the changes that have occurred to date.

- **Independent Power Producers (IPPs) and TVA's Transmission System**

  Any generator, whether directly connected to TVA's system or connected to a neighboring system, can affect reliability and stability on TVA's system and must be managed appropriately.

  Due to the large number of wellheads and gas pipelines in the Southeast, the availability of a seemingly robust transmission system, and a market for additional electricity in the northeast, IPPs are building an abundance of new generating capacity in the region. In the Southeastern Electric Reliability Council (SERC) region alone, more than 37,000 megawatts of new IPP capacity is expected to be online by summer 2003. Currently, there is 4,760 megawatts of net winter dependable IPP capacity connected to the TVA transmission system. By summer 2003, this will increase to 9,750 MW. As these units begin generating and using the transmission grid, there will be increased challenges to the TVA transmission system to provide reliable power to its customers.

Transmission & Reliability Issues

TVA offers the same type transmission services to IPP generators as are offered by other transmission systems. However, most IPP generators have chosen not to invest in system upgrades necessary to ensure long-term firm transmission rights. Instead, virtually all have opted to rely on the availability of nonfirm transmission service. Although TVA makes every effort to prevent it, in the event of a critical situation (e.g., inadequate capacity on the transmission grid, possible interruption of service to customers), nonfirm transmission customers – in accordance with FERC policy – are the first to have their transmission delayed or curtailed.

TVA is responding to this challenge by taking proactive steps to ensure fair and equitable treatment of IPP generators, while fulfilling its mandate to ensure grid reliability. Specifically, TVA is:

- Using industry standard methods and practices in its approach to IPP generators,
- Engaging IPP owners and operators in open discussions to address concerns,
- Developing and implementing consistent operating procedures, and
- Minimizing, wherever possible, the use of Transmission Loading Relief procedures (TLRs), which can result in the delay or curtailment of transmission transactions.

TVA has been very successful to date in minimizing interruptions to nonfirm transmission customers. In fact, of the 2,300 TLRs implemented nationwide in 2001 and 2002 that resulted in transmission delays or curtailments, TVA initiated only 11. Nevertheless, given the projected increase in IPP capacity with nonfirm transmission service, TVA expects that the increased use of TLRs will be unavoidable.

- **The Impacts of Fuel Prices and Geography**

In addition to coping with new generators, additional flows across the grid also occur as a result of fuel price differentials. TVA is geographically positioned between coal mines to the north and gas wellheads to the south. Any differential in price between these primary fuels creates a direct effect on generation costs and the extent to which individual coal-fired or gas-fired generators to the north or south of TVA are able to sell power into the market.

As long as there is a differential between coal and gas prices, TVA's transmission system will see greater utilization as consumers shop for better prices and power is shipped across the region.

Power flows across the TVA region, therefore, present both a challenge and an opportunity for TVA. The challenge is to manage flows to ensure reliability, while the opportunity is to optimize the usage of the transmission-system, recover additional revenues, and, as a result, cover transmission system costs.

Innovative Transmission Cooperation

TVA is committed to providing reliable, low-cost power to the people and businesses within the Tennessee Valley. Even though public-power entities, including TVA, are not subject to FERC jurisdiction with respect to Order 2000 or the proposed Standard Market Design, TVA has taken the initiative in working with neighboring systems to provide seamless transmission services throughout the region.

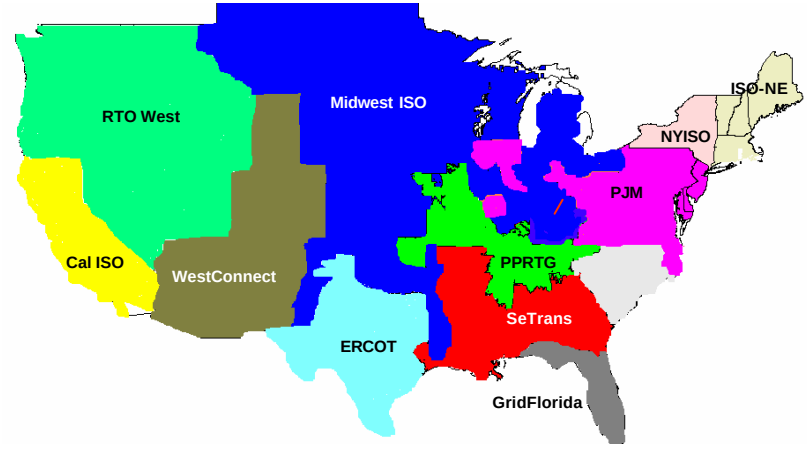
In 2002, TVA and Associated Electric Cooperative, Inc., in Springfield, Missouri, took the initial steps to form the Public Power Regional Transmission Grid (PPRTG). The PPRTG is a mechanism for public-power providers to participate in regional transmission arrangements consistent with the objectives of FERC Order 2000, while remaining within the framework of their public service missions. The PPRTG would initially operate more than 25,000 miles of transmission-lines within a 10-state region, and could grow with additional members.

TVA also entered into memoranda of understanding with three other transmission providers, Southern Company, Entergy, and the Midwest Independent Transmission System Operator, to establish a framework for developing formal regional coordination agreements that will help provide seamless transmission services through a large portion of the Eastern Interconnection grid. The agreements facilitate creating broader solutions to regional transmission control issues while preserving public-power's unique public service mission. Specifically, under the regional coordination agreements the parties would work on developing:

- A simplified transmission rate structure for moving power into, out of, and across the region,
- A coordinated system for reserving transmission service,
- Common methods for managing transmission congestion,
- Coordinated planning and expansion of the grid,
- Common protocols for determining available transmission capacity that may be offered to others,
- Common protocols for ensuring reliability and relieving transmission congestion during emergencies, and
- A common process for connecting generators to the power grid.

Under the agreements, each transmission provider retains existing ownership over its respective system.

Existing and Planned RTOs



The Future of U.S. Transmission Systems

Projections and estimates about future reliability have to be made on the basis of many assumptions. But it is clear that the electricity industry has been drastically changed over the past decade.

These changes have brought new benefits as well as new challenges. In response to these challenges, FERC has tried to foster the development of national energy markets while seeking ways to solve many of these new challenges.

FERC and Standard Market Design

There are currently regional differences throughout the United States concerning how transmission providers offer service, particularly with regard to what happens when the transmission system is congested. FERC has issued a notice of proposed rulemaking regarding a plan it calls "Standard Market Design." The scope and substance of the SMD proposal is a fundamental change in electricity markets in the United States.

FERC states that standardization of the ways that energy is traded, delivered, and sold is desirable. However, FERC acknowledges that it is important that regional differences be respected in this process, because each region is unique in terms of generation types, electricity costs, market participants, and degree of restructuring. FERC is soliciting input from all participants in the national energy market regarding a standard market design.

Reactions to FERC's proposal have been mixed. Higher-cost states in the Northeast, which have a long history of centralized power pools, have been relatively more positive on the market fundamentals and the need for a standardized market model than lower-cost states have been. Some low-cost states fear that the proposal would lower prices in high-cost states at the expense of low-cost regions like the Southeast.

Other critics have noted that the proposed rule would unfairly eliminate native load preferences, which have been used in the past to give the highest priority use of a transmission system to the native-load customers who have historically paid for that system. There is also the fear that the proposal might lead to jurisdictional conflicts between state and federal regulators or cost-shifting to native load because of a lack of workable mechanisms to ensure that those who cause transmission upgrades also pay the cost. Criticism of FERC's aggressive timetable also has been widespread and Congress has passed legislation that will require a detailed cost-benefit analysis of SMD.

FERC has indicated informally that the SMD structure it originally proposed will be modified before it issues the final rule, based on feedback received to date. Whatever the final structure of FERC's design, SMD, if enacted, will likely have an impact on various components of the industry, including:

- *Transmission Tariffs*
- *Transmission System Control*
- *Distribution Companies*
- *Integrated Utilities*
- *Wholesale Transactions*
- *Merchant Generation*
- *Existing Long-Term Power Contracts*
- *Existing Transmission Agreements*

Going Forward

TVA is not subject to FERC jurisdiction with regard to the issues associated with FERC's SMD proposal. Nevertheless, electric-power markets surrounding TVA are already transitioning into markets that have strong SMD features. Consequently, TVA's future purchases of power from those markets will need to be in accordance with SMD principles, and care will need to be taken that any of TVA's future sales of power into those markets will continue to be in accordance with the requirements of the TVA Act.

TVA is committed to providing reliable, low-cost power within the Tennessee Valley. TVA will continue to work with surrounding utilities and with FERC to ensure seamless transmission throughout the region.